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TITLE: Audio codec with digital level adjustment and flexible channel assignment

DATE-ISSUED: June 30, 1998

INVENTOR-INFORMATION:

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US-CL-CURRENT: 381/119; 341/141, 341/143, 370/266, 370/267, 379/202.01, 381/118

CLAIMS:

What is claimed is:
1. An apparatus for coding and decoding sound signals, said apparatus receiving a
plurality of input sound signals on input signal lines and producing a plurality
of digital output signals on output signal lines, said apparatus comprising:
a plurality of delta sigma modulators, each of said delta sigma modulators
receiving a different one of the input sound signals and producing a serial
digital sound signal having pulses determined by the corresponding input sound
signal;
a plurality of level adjustment circuits, each of said level adjustment circuits
corresponding to one of said delta sigma modulators and receiving the serial
digital sound signal produced thereby, and each of said level adjustment circuits
receiving a predetermined weight value for each of the output signal lines and
respectively outputting a weighted digital signal for each of the output signal
lines based on the corresponding weight value, the predetermined weight values
being independently selectable; and
a plurality of combiners, each of said combiners respectively combining the
outputted weighted digital signals corresponding to one of the output signal
lines.
2. An apparatus for coding and decoding sound signals, said apparatus receiving a
plurality of input sound signals on input signal lines and producing a plurality
of digital output signals on output signal lines, said apparatus comprising:
a plurality of delta sigma modulators, each of said delta sigma modulators
receiving a different one of the input sound signals and producing a serial
digital sound signal having pulses determined by the corresponding input sound
signal;
a plurality of level adjustment circuits, each of said level adjustment circuits
corresponding to one of said delta sigma modulators and receiving the serial
digital sound signal produced thereby, and each of said level adjustment circuits
receiving a predetermined weight value for each of the output signal lines and
respectively outputting a weighted digital signal for each of the output signal
lines based on the corresponding weight value and
a plurality of combiners, each of said combiners respectively combining the
outputted weighted digital signals corresponding to one of the output signal
lines;
wherein each of the weighted digital signals output from each of said level
adjustment circuits comprises one of the corresponding predetermined weight value
and a negative representation of the corresponding predetermined weight value.

3. An apparatus as recited in claim 1, wherein each of said level adjustment circuits comprises means for selecting, for each of the weighted digital signals, one of the corresponding predetermined weight value and a negative representation of the corresponding predetermined weight value based on the sign of the serial digital sound signal.

4. An apparatus as recited in claim 3, wherein said combiners are adders, and each of said adders respectively adds the outputted weighted digital signals corresponding to each of the output signal lines.

5. An apparatus for coding and decoding sound signals, said apparatus receiving a plurality of input sound signals on input signal lines and producing a plurality of digital output signals on output signal lines, said apparatus comprising:

a plurality of delta sigma modulators, each of said delta sigma modulators receiving a different one of the input sound signals and producing a serial digital sound signal having pulses determined by the corresponding input sound signal;

a plurality of level adjustment circuits, each of said level adjustment circuits corresponding to one of said delta sigma modulators and receiving the serial digital sound signal produced thereby, and each of said level adjustment circuits receiving a predetermined weight value for each of the output signal lines and respectively outputting a weighted digital signal for each of the output signal lines based on the corresponding weight value; and

a plurality of combiners, each of said combiners respectively combining the outputted weighted digital signals corresponding to one of the output signal lines,

wherein each of said level adjustment circuits comprise a plurality of registers, each of said registers storing one of the predetermined weight values associated with said level adjustment circuit, and each of the predetermined weight values within each of said registers corresponding to a different one of the output signal lines.

6. An apparatus as recited in claim 5, wherein said combiners are adders, and each of said adders respectively adds the outputted weighted digital signals corresponding to each of the output signal lines.

7. An apparatus as recited in claim 1, wherein each of said level adjustment circuits comprise a register file, said register file being associated with one of said delta sigma modulators and storing a plurality of the predetermined weight values, each of the predetermined weight values within said register file corresponding to a different output signal line, and said register file producing a plurality of the weighted digital signals.

8. An apparatus as recited in claim 7, wherein said combiners are adders, and each of said adders respectively adds the outputted weighted digital signals corresponding to each of the output signal lines.

9. An apparatus as recited in claim 1, wherein said apparatus further comprises at least one digital-to-analog converter for converting at least one of the weighted digital signals to an analog output signal.

10. A method for coding sound signals for digital sound output signal lines, comprising:

(a) receiving analog sound signals, each of the input sound signals being received on a different input signal line;

(b) producing digital sound signals from each of the analog sound signals, each of the digital sound signals corresponding to one of the analog sound signals and including a serial stream of pulses determined based on the amplitude of the analog sound signal corresponding thereto;

(c) obtaining independently selectable digital weight values for each of the digital sound signals, the weight values for each of the digital sound signals including a weight value for each of the digital sound output signal lines;

(d) producing weighted digital sound signals for each of the digital sound output signal lines based on the digital sound signals and the weight values; and

(e) for each of the digital sound output signal lines, summing the weighted digital sound signals directed to each of the digital sound output signal lines, thereby producing signals for the digital sound output signal lines.

11. A method for coding sound signals for digital sound output signal lines, comprising:

(a) receiving analog sound signals;

(b) producing digital sound signals from each of the analog sound signals, each of the digital sound signals corresponding to one of the analog sound signals and including a serial stream of pulses determined based on the amplitude of the analog sound signal corresponding thereto;

(c) obtaining weight values for each of the digital sound signals, the weight values for each of the digital sound signals including a weight value for each of

the digital sound output signal lines;
(d) producing weighted digital sound signals for each of the digital sound output signal lines based on the digital sound signals and the weight values, for each of the digital sound signals said producing the corresponding weight value or its complement for each of the digital sound output signal lines; and
(e) for each of the digital sound output signal lines, summing the weighted digital sound signals directed to each of the digital sound output signal lines, thereby producing signals for the digital sound output signal lines.
12. A method as recited in claim 11, wherein said producing (d) outputs the corresponding weight value if the corresponding digital sound signal is greater than zero, and outputs the complemented weight value if the corresponding digital sound signal is not greater than zero.
13. A method as recited in claim 10, wherein the weight values are being determined so as to provide a logarithmic response.

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5	4	("6266644" "6201798").pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:17

-	11	(704/50?.ccls. and audio adj data same compress$3) and tag$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/18 14:28
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-	6	(sinusoidal adj model$3) and (subband$3 subdivid$4 sub-band$3 segment$3 and streams)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/18 15:15
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-	1893	704/?.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/19 21:04
-	2	704/?.ccls. and coding same (sound audio) adj signal	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/19 21:05
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-	5	704/?.ccls. and (sound audio) adj signal same (segment$1 subdivid$3 subband$3 sub-band$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/19 21:13
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-	1	5469527.pn. and coding same signal and stream?	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/19 21:32
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-	2392	375/$.ccls. and modulo	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/19 21:49